UNIVERSITY DEPARTMENT OF ZOOLOGY

Synopsis

"A STUDY ON ROLE OF SOIL MESOFAUNA DIVERSITY ON ECOSYSTEM FUNCTIONING AT VEGETABLE GARDENS OF RANCHI".

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GATE

A study on role of Soil Mesofauna diversity on ecosystem functioning at vegetable gardens of Ranchi.

STATE OF ART

Soil is one of the most significant ecological factors which is derived from the transformation of surface rocks[1,2]. The word soil is derived from a Latin word *solum* which means earthy material in which plants grow[1]. Soil is a large reservoir of various organisms which together help in regulation of various biogeochemical cycles[2,3]. Soil biodiversity is comprised of the organisms that spend all or a portion of their life cycles within the soil or on its immediate surface (including surface litter and decaying logs). The soil mesofauna are an important part of terrestrial ecosystems[4] and a connecting link between microfauna and macrofauna which together form an essential part of soil decomposer community[5]. They perform and regulate a major proportion of the organic matter transformations and nutrient fluxes in terrestrial ecosystems[6]. The fluxes and flows are regulated to large extent by Soil mesofauna, being considered as 'Ecosystem webmasters'[7,8].

A soil mesofauna is an invertebrate group (aptera) found within terrestrial samples with the size ranging from 0.1-2mm which include organisms/orders like Acari, Collembolans, Proturans, Diplurans, Symphellids, Enchytriaeds etc[9]. Large numbers of the microarthropod group (mainly mites and collembolans) are found in most types of soils[10].

The role of soil mesofauna in shaping the soil structure is not significant, as their body dimension allow them to use the existing pore structure created by macrofauna[11], yet they play an important role in decomposition and nutrient cycling and hence ecosystem functioning[12,13] due to their trophic interlinking function between microfauna and macrofauna[14,15].

The disturbance or perturbation of soil viz. tillage, application of pesticides reduces the mesofaunal population which negatively affects ecosystem functioning[16,17]. The recovery response of mesofauna is quite rapid as they

respond differently and post cultivation dramatic increase in population and diversity has been reported.

Jharkhand is a state with high potential in cultivation of vegetable and other horticultural products[18]. Presently about 2.2 lac hectare area is under vegetable production with an average of 3.5million ton production[19].

The major vegetable crops grown in the state in order of area covered by them are Potato, Tomato, Lady finger, Peas, Cauliflower, Brinjal, & Cabbage[19]. Ranchi is one of the prime district in vegetable production. In Ranchi areas like Boreya, Kanke, Pithoria, Samlong will be considered for collecting samples.

PROBLEM TO BE INVESTIGATED

1. Impact of tillage on biodiversity, distribution and abundance of mesofaunal population to understand soil ecosystem functioning
2. Comparative study of faunal composition of soils at various vegetable fields sites
3. Role of mesofauna in Nutrient cycling and soil fertility
4. Correlations between abiotic factors and biotic mesofauna components of vegetable garden.

OBJECTIVES OF THE INVESTIGATION

To generate a base line data on biodiversity of mesofauna of vegetable gardens of Ranchi and to study their role in nutrient cycling and conserving soil ecosystem.

MOTIVATION

Soil biodiversity is highly threatened by human activities such as deforestation, change in land use and intensive agriculture. Understanding soil biodiversity will help us to identify the conservation strategies to protect soil ecosystem.

HYPOTHESIS

Tillage is a regular activity in vegetable field. Soil mesofauna are considered as an early colonizer. It is being proposed that the fast growth and recolonization of mesofauna after tillage helps to maintain the normal decomposition and nutrient cycling in soil ecosystem.

RESEARCH DESIGN AND METHODOLOGY

1. The mechanical analysis of soil sample of various sites of vegetable field will be carried out in four different climatic seasons.
2. Soil temperature will be measured by inserting a soil thermometer to a certain depth.
3. The moisture content will be determined by drying the soil in an electric oven .
4. The pH will be measured by using a standardized pH meter in soil suspension.
5. Rapid titration method for calcium carbonate and Walkley and Blacks method for organic carbon will be adopted.
6. The particle size will be measured by using an ocular micrometer taking 1000 particles at random.
7. Statistical tools like Correlation, Regression, ANOVA will be used for data analysis .
8. The Litter and the plant debris will be collected with the help of a tool commonly Known as “Khurpi”.
9. The Plot of land will be selected for sampling of the epidaphic and euedaphic forms and measured with wooden quadrant.
10. The Soil sample will be obtained with the help of circular corers. In all quantitative studies for estimation of population of soil fauna, two types of corers are used in general i.e. rectangular and circular. A circular is a better device for coring soil with a fairly abundant population of soil fauna.

In the present investigation, a circular corer based on the principle of O'Connor will be used to minimize the casualty of delicate soil fauna by compressing the soil with a slight modification.

After each operation, collected soil sample will be put in the Tullgren funnel upside down to facilitate the movement of the soil fauna.

11. The Behavioral dynamic method (Wallwork, 1970) will be employed to isolate the soil fauna from the litter and the soil. This method is based upon the principle of behavioral responses of the animals such that they leave the soil after being subjected to the appropriate stimulus e.g. heat illumination and desiccations.

    The extracting device will be composed of three components.

    a) The heat will be provided with the illumination of 60-watt bulb covered under an aluminium cover measuring 30.5 cm high.

    b) An aluminium vessel with a sieve at its base with a diameter of 7.5cm.

    c) An aluminium funnel without joint measuring 23cm in height.

Below each funnel the collecting vials will be placed containing about 5ml of 70% alcohol solution. The litter and the soil will be exposed to the illumination for a period ranging from 36 to 72 hrs. The illumination will gradually be increased from low to high intensity by means of the regulatory fitted in the extracting device.

A stereoscopic binocular microscope will be used for counting the mesofauna population. The insects will be separated from mites and preserved in 70% alcohol. Apterygotes will be mounted in polyvenyl alcohol.

TOOLS TO BE USED-

- Soil-thermometer
- Electric oven
- PH meter
- Occular micrometer
- Wooden quadrate
- *Khurpi*
- Circular corers
- Stereoscopic binocular microscope
- Titration apparatus
- Sprit lamp
- Cover glass

CHEMICALS TO BE USED

- Calcium carbonate
- Polyvenyl alcohol
- Distilled water
- Glycerin
- Lactic acid
- Gum Arabic

- Chloral hydrate
- DPX
- Xylene
- Cedar wood oil

SIGNIFICANCE OF THE STUDY

The present study will proffer an idea about decomposition potential, nutrient cycling and assimilation of organic matter in vegetable field . This will lead to an understanding towards agriculture practices and role of mesofauna in nutrient cycling.

As the soil community constantly encounters perturbance in vegetable field in terms of delve, tillage, fertilizers, pesticides, etc. , a detailed understanding of recolonization behavoiur will give an array of nudation and succession in an ecosystem.

The soil mesofauna regulate ecosystem productivity and microbial biomass and are key orgamisms to regulate ecosystem production, especially in nutreint limited ecosystem a better understanding will help to achieve the enormous potential of cultivation of horticultural crops in state.

CONTRIBUTION TO THE EXISTING KNOWLEDGE

Despite their importance in agroforestry, soil mesofauna largely remained unexplored in India. Recently biodiversity of mesofauna have been explored in in reclaimed sites of Jharkhand yet very few works have been reported in field of vegetable gardens. Present study will assist in management of agricultural practices and land use of vegetable gardens.

FUTURE WORK

The work can be extended to different type of ecosystems viz. Forest, Agricultural field, reclaimed sites, plantation sites, grasslands, arable lands to

have a detailed understanding of soil ecosystem functioning and developing strategies for soil biodiversity conservation.

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